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FORM COPYING AND READING ABILITY

BY

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A THESIS

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The undersigned certify that they have read, and recommended to the Faculty of Graduate Studies for acceptance, a thesis entitled "Form Copying and Reading Ability" submitted by Bruce Campbell Bain in partial fulfilment of the requirements for the degree of Master of Education.

ABSTRACT

In this study the relationship between copying geometric designs and reading ability in school-age children was investigated. A significant correlation between Bender Gestalt scores and Stanford reading scores was expected. Thirty first-grade and thirty second-grade pupils performed both tests. Grade one correlation was $r=.41$ ($P<.05$) and grade two correlation was $r=.37$ ($P<.05$). The seven-year olds were higher ($P<.01$) than the six-year olds in both form copying and in reading. No sex difference in performance was found. The Bender was administered via an overhead projector to the two groups. This technique showed promise as a gross screening instrument, but was not sufficiently accurate for individual prediction.

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CHAPTER I

INTRODUCTION

One group of children who are neither well identified nor well provided for within our present educational system are those children whose development may be slow, and for whom we might in advance predict reading difficulties. Research (Goodenough, 1926; Bender, 1938; Prescott, 1957; Langmeier, 1961; Koppitz, 1964; Faust & Faust, 1966) has led to the suggestion that reading difficulty can result from a poor match between developmental maturity and the demands of a beginning reading program. Reading disability might be prevented in many instances if reading expectations could be better matched to the developmental status of children.

Kostyuk (1966) cites experimental evidence to confirm the thesis that the influence of learning on mental development is mediated: (1) by the age possibilities of the children, which depends on the state of body maturity and the maturity of its central nervous system; and, (2) by individual differences in maturation. These theses are supported by Hebb (1949), Gibson & Gibson (1955) and Forgus (1966). Other research (Prescott, 1957; Olson, 1959; Koppitz, 1964) demonstrated that as children progress through school experience, individual differences increase and the similarities of the age-grade pattern decrease. Broadly conceived, this study of grades one and two pupils' performance on a copy task

will attempt to highlight the problem of reading performances as one of maturation and development.

THE PROBLEM

A comprehensive research design involving all known factors related to reading would necessarily be unweildy. It was the purpose of this study to examine only the visual-motor functioning of readers. Considerable research has been reported which investigated the possible perceptual basis for reading disabilities of children. As early as 1926, Gates, in his study of visual perception and reading, found that retarded readers in the primary grades developed difficulty in "word perception". Since then continued research has been conducted (Vernon, 1958; Elkind, Koegler & Go, 1964; Gibson, 1965; Faust & Faust, 1966; Galperin & Patina, 1966) to investigate the relationship of visual-motor perception and reading disabilities in the primary grades. In general, it was found that reading competence in the early levels of development is based upon the perception of the letter-symbols which are integrated to form whole words and thus develop meaning for the child. Without visual-motor perception, all other areas of reading readiness appear useless - without word recognition, reading is not possible.

The problem under investigation is that of measuring the development of visual-motor skills believed to be closely related

to the ones involved in the process of learning to read, and, through appropriate statistical procedures, that of determining what relationships exist between an individual's perceptual ability and his reading ability.

A sub-problem is that of considering the value of using a form copying test, administered on a group basis, as in instrument for judging reading readiness and for predicting reading achievement.

First and second grade pupils were selected for this research as it was found that the average child at these ages is rapidly maturing in visual-motor development, (Koppitz, 1964), and secondly, it is the usual age-grade period for beginning to read. Faust & Faust (1966) also found that this is the age of most rapid perceptual development. It was generally assumed that a deficient development of perceptual integration at this age would result in a corresponding decrease in the correct response in perceptual-motor functioning.

<u>Significance of the Study</u>

The findings of this study may provide a basis for a rationale and technique that could be used by specialized personnel in making more consistent evaluations of form copying ability as it relates to reading performance. An indication of which instructional techniques and materials to provide for the young learner would be most useful.

Group administration would overcome the greatest handicap in evaluating large numbers of school beginners. In most school settings the time required for individual test administration is as yet prohibitive.

Essential Variables, Hypothesis, Definitions

Essential Variables

(1) The independent variable is copying ability.

(2) The dependent variable is reading ability.

Hypothesis to be Tested

(1) There is a significant positive correlation between copying ability and reading ability in grades 1 and 2.

Age, Sex, and grade placement will be considered in the interpretation of the results.

Definition of Terms

Development - refers to a way of thinking about the emergence of change and stability in human functioning, and the way in which various changes are related to each other. Specifically, how progressions in visual-motor functioning relate to reading ability.

Form Copying - the reproduction of non-representational line drawings.

Form Copying Ability - the specific motor response to nine Wertheimer (1923) designs of the Bender Visual-Motor Gestalt Test (Bender, 1938) as measured by the Koppitz,

Revised Developmental Bender Scoring System (1964).

Reading Ability - the interpretation of printed symbols as measured by the Stanford Achievement Test, Primary I Battery, Sub-Tests, W.R., P.M., and W.S.S. (1964).

Visual Perception - That process by which stimuli are apprehended and registered in the cerebral cortex through the medium of the eye (Gregory, 1966). The input of sensory stimuli is never into a quiescent system but always into a system which is already excited and set (Gibson & Gibson, 1955; Natadze, 1966; Fantz, 1967).

Visual-Motor Perception - the whole setting of the stimuli and the whole state of the organism which determines the pattern of the response (Bender, 1938) while in a state of becoming (Allport, 1955; Zaporozhets, 1966; Piaget, 1961; Sartre, 1965).

Visual-Motor Integration - the process of sensitizing all sensory inputs, the effects of past experience or set, and the responding in a motor activity (Gibson & Gibson, 1955).

Visual-Motor Functioning - that function of the integrated organism whereby it responds to a given constellation as a whole (Bender, 1938; Piaget, 1961; Natadze, 1966).

Limitations and A Word of Caution

Limitations

(1) It was assumed that the pupils had been exposed to a

developmental reading program typical of the public school education in Edmonton.

(2) There was no evaluation of the control of variations in teacher-personality, teacher-methods, or mobility of the pupils.

(3) Measures of visual acuity and other related opthalamic functions were not collected, hence pupils deficient in this area were subsumed at the lower end of the scale.

(4) The experimental design is more screening than diagnostic in purpose.

<u>A Word of Caution</u>

Only simple problems have simple solutions. Complex problems such as reading disabilities have various causes - poor visual acuity, distractibility, lack of meaningful concepts. Leontiev (1959) claimed that the etiology ranges from physical to psychological. Many factors need to be better understood. One of these factors is perceptual development, which is the concern of this paper.

CHAPTER II

RELEVANT LITERATURE

The purpose of this chapter was to review some of the research relating to the perceptual process and to briefly describe the nature of perception.

The Process of Perception

The term perception has occurred frequently in the literature of education and psychology. The term was generally used to refer to studies of learning and thinking - cognition. Allport (1955) and Zinchenko (1962), to name but two authors, have analyzed the various theories, themes and concepts of perception. It would not benefit this study to elaborate on their findings of the concept of perception as it related to the organism-as-a-whole, except to indicate that there were several similarities between the fundamental concepts of perception and visual-motor perception. It was generally found that: (1) perception is unobservable; (2) perception as a term denotes a process; and, (3) perception involves a product. The universal requirement was that a stimulus be present and a product be observed. The various theories of perception tended to be based on the observable. The variations among the theories of perception, as related to development, appeared to center around the variations in identifying the components involved in the perceptual process.

General and Specific Perceptual Components

The review of the literature was limited to visual perception

as it related to reading. It was of significance to note however, that many hypotheses of visual perception were based on similar observed data and inferred functions as in the case of total perceptual development. This was evidenced by definitions of visual perception given by researchers in the area of visual perception and reading. Gregory (1966) for example, identified visual perception as, that process by which phenomena are apprehended by the cortex through the medium of the eye. Gates (1926) felt it was a more complex function. He stated: "What we call visual perception is not a single unitary process which acts uniformly upon all data and under all conditions; perception on the contrary is specialized" (p.120). He indicated that perception was not a generalized ability, but that there were abilities to perceive words, digits, geometric figures, each relatively independent of other perceptual abilities. These conclusions were derived from research in which he found the highest correlation to be between word perception and reading development, the next highest between Stanford-Binet and verbal tests, and the lowest between perception of digits and geometric designs and reading ability. Gates concluded that there was little evidence of a general visual perception and that visual perception was specialized.

Phelan's (1940) investigation supported this "specialized" concept in part, but also found some evidence of a group factor, described

by Spearman (1941) as a general ability. Fendrick (1935) on the other hand reaffirmed that there was a specific factor of visual perception as related to reading.

Thurstone (1954) found among his primary mental abilities, a perception factor of an "undeterminate nature". This factor was described on the basis of a factor analysis as a facility in perceiving detail that is imbedded in irrevelant material. It was especially true of "Identical Forms", a test which required that a first figure in a line was to be matched with an identical one in a row of figures. In a second study Thurstone (1954b) identified a "closely related factor" which was termed a perception factor. This perception factor was related to a common experience in connection with three tests, namely, "Highest Number, Identical Number and Identical Name".

Thurstone (1954b) concluded that a general factor was evident in verbal and non-verbal items. Natadze (1966) and Forgus (1966) concurred with this view.

Witkin et. al. (1949, 1954, 1962) investigated the field dependence-independence dimension of perceptual functioning. Three situational tests were devised to evaluate this function: (1) Body-adjustment; (2) Rod-and-frame; and, (3) Embedded figures. Each situation required the subject to keep an item - his body, a rod, or a geometric design - separate from the context of which it

was a part. He was required to deal analytically with a field or a configuration. Witkin concluded : (1) "Under the same field conditions and with a force of the same magnitude and direction working on their bodies, people differ markedly in their perception" (1949, p. 240); and, (2) "Not only are individuals consistent in their performance across tests, but they are consistent over time (as long as 7 years) as well" (1962, p. 248).

The revelence of the Witkin studies to the present report is: (1) to lend considerable evidence to the concept of a general factor in perception; and, (2) that one method of instruction is not effective for all people.

<u>The Integrating Process</u>

There have been numerous attempts to identify or explain the integrating process inferred above. Pavlov (1928), Hebb (1949), Penfield and Roberts (1959) and Luria (1966) were among the major contributors to this area. Penfield and Roberts concluded, following considerable research with children whose neurological impairment was affecting their reading development, that the integrating process involved two phases: (1) impulses derived from the motor activity of the organism, directed toward the outside world and formed under the influence of information on events taking place in the external world; and, (2) impulses arriving from the internal environment of the organism. "A comprehensive analysis of all that

takes place outside and inside the organism as a result of its own activity is possible. As the morphological and physiological basis of the most complex forms of man's mental activity, the frontal portion of the cortex, in which external and internal information is integrated and transformed into definitive motor acts that determine the behavior of the organism-as-a-whole, may be considered to have cardinal importance in man" (Luria, p. 69). Other research (Hebb, 1949) contains the suggestion that any pattern of incoming neural impulses is being constantly elaborated. This elaboration involves the addition of other stimuli present in the organism at the moment, and the alteration and modification of these stimuli resulting from modifications in the organism based on its past experience. Pavlov stated simply: "...that neural activity is a complex interconnected product of sociohistorical development" (1928, p. 10).

In a detailed explanation of perception, Luria expanded on the concept of return afferentation. In any voluntary activity a constant comparison of the planned acts and the effects achieved is necessitated. "This means that a continuous feedback of signals must take place from the performed movement ('performance signals'), constituents of the afferent organization, and the plan of action. In this way there is a constant corrective principle, providing for the liability of deviation from a given plan" (Luria, p. 235). The

characteristics of these corrections initially taking place after the movement has been carried out (secondary corrections), and subsequently applied during the course of activity (primary corrections),have been described by Luria (1965). From all evidence, this mechanism of comparison of the plan of action with its actual effect is what Anokhin (1966) called the "acceptor of action". The acceptor of action may be regarded as a general mechanism of the self-regulating system.

The Nature of Perception

The characteristics of perception may be said to include the individual's awareness of the object, the conditions of his environment and the impression that the objects make upon his senses. Perceiving, then, is a process of an individual's adjustment which is determined by many factors: emotional state, needs and desires, fatigue, frustrations, learning, acceptance or rejection - in other words his set. Perception cannot be considered a static condition operating within the organism, but rather a variable activity by which an organism adapts itself to its surroundings.

The two main aspects of perception are the physiological and the phenomenological (Zaporozhets, 1960b). These aspects are closely associated in the total process of perception, yet they are essentially different. This study was concerned with

visual perception, however a concise summary of the neurological processes involved may illuminate the phenomenological concept.

The physiological process begins with some object or pattern of events being present to be perceived. There are intervening light waves that produce an excitation on the retinal surface. The resulting impulses move along afferent neurons from the analyzers to the brain. A pattern of events, which is not fully understood (Hebb, 1949), occurs in the lower brain stem and in the cortex to provide feedback via return afferentation to allow for accommodation by the eye. The primary visual center is in the occipital lobe of the brain; closely associated is the visual recognition area and the visual reading area which is the co-ordinator of visual activity (Penfield & Roberts, 1959). Although the brain as a whole is the material base of the higher nervous processes (Pavlov, 1928) and the brain is a highly differentiated system whose parts are responsible for different aspects of that whole (Luria, 1966; Shorokhova, 1966), the various phenomenan attributed to the brain appear to be integrated by the frontal lobe (Pavlov, 1929; Penfield & Evans, 1935; Luria, 1966). Only the primary visual center receives and sends information to and from the peripheral nervous system, the internal organs and the involuntary muscles. The visual percept and the neurophysiology of the organism may be said to work in conjunction with each other,

for the human organism is constantly trying to understand his environment. Although the objects or events of the environment appear isolated and independent of the perceiver, they are known only the way in which the perceiver views them. Perception, then, becomes a function of the perceiver and of the object. The position of the perceiver's body or head as well as his goals, fears, barriers, expectations and learning determine the properties of what is perceived. This set has its corrollary in the environment. Many stimuli have a constant relationship to their background. This physical constancy in addition to the psychological perceptual constancy aids in recognition of stimuli. The individual learns to be aware of the dependable features of a stimulus or of a kaleidoscope of stimuli so that identification becomes possible in spite of variations to the stimuli. Learning of new information becomes a case of change of perceptual set.

This study was concerned with evaluating an individual's ability to recognize and reproduce various stimuli believed to be related to the reading process. However in perception a person uses his sensory impressions of touch, hearing, feelings---etc., as well as those of vision to aid in interpreting a stimulus, thus placing the organism-as-a-whole under investigation. For the sake of parsimony some limitations had to be placed. Operationally visual perception has been looked at and defined as an integrated pattern

of sensory-motor activity involving constantly changing positions of eyes and the results of previous patterns of stimuli. Henceforth, "perception" will refer to "visual perception."

Since research with adults appears to indicate that perception is unique to the person, the developmental process that preceeds mature perception is pertinent to this paper.

CHAPTER III

THE ONTOGENESIS OF PERCEPTION

There was generally agreement in the literature that infants are born with a number of unconditioned orienting reflexes consisting in movements of the receptor apparatus in the direction of a new stimulus. There were numerous interpretations of this phenomena: Hebb (1949), "sensory pre-linkages;" Hayek (1952), "sensory pre-conditioning;" Gibson and Gibson (1955), "afferent discrimination." The significance of the visual preference studies (Tinbergen, 1952; Lorenz, 1958; Fantz, 1965b, 1967) is that infants from birth do have the capacity to receive and discriminate certain stimuli. To Zaporozhets and Zinchenko (1966) these unconditioned reactions constitute the basis for the formation of perceptual activity.

Notwithstanding the various theories and interpretations the researchers agreed that acquisition of information is influenced by many factors in the infants environment in addition to his initial pattern preferences. The visual world is structured; certain parts of it attract greater attention than others. Solid objects often contrast with a more uniform, distant ground, in color, brightness, and patterning. Some of these objects move, which further sets them apart from the ground and attracts attention. Other objects (e.g., human faces, the child's own hands) are frequently close to the infant and thereby gain in retinal size, optical clarity, and

visible details. There are many theories and a wealth of research concerning the subsequent perceptual behavior. One of the most detailed and comprehensive reports has emanated, over a period of years, from the work of Jean Piaget and his associates.

Piaget and Inhelder (1948, 1951, 1956) found in their studies of infant's perception that there was no indication that the infant had any general idea or any perception of a single spatial continuum or organization. They observed the infant to react towards sensory stimulus initially with a single response; he oriented toward a mouth, a visual, or an auditory space, but only toward one at a time, with disregard for others. The child was seen to follow objects with his eyes and to adjust the convergence points of his eyes so that they focused on an object either when it was moved, or when he was moved. Convergence was found to become fairly accurate by the time the child was eight months old. At approximately six months of age he was observed to co-ordinate the visual and tactile aspects of objects. This was demonstrated by his reaching with some degree of accuracy for objects that were close to him. At this point, Piaget believed the child differentiated between objects in space as being either close or distant. At eight-to-nine months the child was observed to become aware of the effects of distance on the appearance of size. The child

began to locate objects somewhat concealed but could not judge his own movements in relation to objects in his path of locomotion. By the age of one-and-a-half, he was able to detour around objects, and to turn objects so that they might be pushed or pulled through narrow spaces, such as the bars of a play pen. By the end of the second year, as his concept of space had developed through reaching for objects or by his crawling towards things, he developed the use of spatial terms, such as "up", "down", or "where".

The age-stage relationship to Piaget is relative. The actual age at which each individual develops a particular skill is more-or-less unique. The succession of stages however are very much alike.

Piaget further claimed that the child, until approximately four years of age, is unable to view objects from any other viewpoint but the one directly given.

Piaget asked: "What will happen when it is a question of perceiving distant objects, and of coordinating the perspective of different observers?" He answered: "The child is placed opposite a small model of three mountains, and given a certain number of colored pictures of these mountains; he is then asked which of the pictures show the mountain from the (different) positions occupied successively by a doll on the mountains in

the model. The function of age in his development of these reactions is very clear. The littler ones do not perceive that the observer sees the same mountain quite differently from different points of view, and hence they consider their own perspective absolute. But the older ones perceive the relativity necessary to objectivity...." (1937, p. 100). When the same children were asked to arrange models according to a given pattern, the four-to-six year olds demonstrated some degree of spatial knowledge; the seven-to-ten year olds were able to copy the model correctly but not the distance between objects, especially if the scale was different from that of the model. It is important to note that the development of visual skills did not correspond to a specific age for all children. It may be inferred that the use of chronological age is not the most accurate method of determining when a child has the visual readiness appropriate for understanding written instruction.

When children were asked to draw houses, people, and trees on a hill, the five-and-six year olds usually oriented their figures on the vertical slope of the hill rather than on the horizontal plane. Piaget found that children do not show the ability to judge accurately the size of distant objects until after the age of five. He concluded that experience is an important factor enabling to compensate for perceived size with

respect to perceived distance. For example, a child requires experience to learn that parallel lines do not meet, or that houses seen at a distance are a constant size.

The findings of Piaget and Inhelder were in general agreement with those made by Zaporozhets.* The similarity of data render it unnecessary to elaborate on the latter's views.

Perceptual Constancy and Reading

Granted the interrelated and complex nature of the reading process the inportance of perception to reading is obvious. For the beginning reader, letters are meaningless or arbitrary shapes, hard to identify and to reproduce correctly in the proper orientation (Gibson, 1965). By contrast, objects which the child deals with everyday are more meaningful. With respect to objects which they use and manipulate, children gradually develop the notion that objects remain constant in size and shape, independent of movement around them or the objects orientation in space. Natadze stated that: "perceptual constancy is conditioned by practical interrelations between the living being and his surroundings is, of course, incontestable. A living being develops an ability to

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*See: Veer, M. A.V. Zaporozhets: A Soviet Developmental Psychologist. Med. Dissertation, U. of A., for a cogent analyses of the respective positions.

perceive stable, real properties of the object, with which he establishes practical relations, and not the seemingly, illusory qualities which change in accordance with the character of and intensity of the luminance, distance from the object or perspective in which it is perceived" (1966, p. 432).

Piaget (1930) noted that a young infant cannot recognize his own bottle if the nipple is covered and if the bottle is presented to him "bottom-end-first." By contrast, an older child has establised the notion that the "meaningful" nipple-end can be reached by simply turning the bottle around. The bottle is reversible and the properties are constant.

The child learns, with difficulty, that position and orientation do not affect the size, shape or meaning of objects in the world (Piaget, 1930). When he starts reading he is confronted with the confusion that small variations in size, shape, and orientation greatly affect their meaning (Gibson, 1965). Although a coin is a coin whether seen as "heads" or "tails", a b becomes a d when the direction is reversed; and a d becomes a p when rotated.

Faust and Faust stated: "In addition to the complication which letter-symbols present, words are 'whole shapes' which are made up of component letters. These parts have specific relationship to each other and to the whole word. When the parts change position, are reversed in space, or are changed in size, the meaning of the

word is drastically altered. In addition, the spaces between the 'whole shapes' demarcate words; small dots separate sentences from each other. All of these perceptual properties are crucial and so any dislocation or omission, necessarily leads to confusion and loss of meaning for the child" (1966, p. 97).

When considering perceptual development, it is clear that if forms are too complex for a child's level of development then the parts predominate in perception (Vernon, 1958; Langmeier, 1961; Koegler, Elkind & Go, 1964; Faust and Faust, 1966; Koegh & Smith, 1967). Galperin and Pantina stated: ".... if the contours (forms)* are too complex for the child's perception they cannot be encompassed in one moment and in a non-disected form" (1965, p. 426). The pattern is analyzed or broken apart and cannot be integrated back into a complex whole with the parts meaningfully organized (Marchbanks & Levin, 1965). That is in complex form perception, the isolated details and parts can be noted before the whole Gestalt is properly integrated. As the child develops he is able to deal with more and more complex patterns in an integrated way (Piaget & Inhelder, 1956; Yudin, 1967). Developmental trends in perceiving and analyzing complex wholes can be seen in children's reproductions of forms (Koppitz, 1964; Yudin, 1967) and were investigated in this study

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*author's parenthesis

by the nine Wertheimer (1923) designs of the Bender Visual-Motor Gestalt Test (Bender, 1938).

Form Copying and Reading

There was evidence to suggest that the developmental characteristics defined for the form copying task are related to reading performance. Bender (1938) considered reading ability to be closely associated with aspects of visual-motor development which could be operationally measured by a form copying task. Bender indicated that certain minimal levels of development were necessary before a child could learn to read. Any delay or disturbance of the visual-motor function could be a major factor in reading disability. Reading disability then would be expected to be reflected in performance on a copy task. Koppitz simply stated: "a certain degree of development in visual-motor perception is necessary before a child can learn to read. An essential part of the complex reading process is the perception of patterns, spatial relationships, and the organization of configurations. Since the Bender Test reflects the maturation level of visual-motor perception in young children, it stands to reason that Bender scores would be related to reading" (1964, p. 61).

Developmental Changes in Form Copying

A major work concerning the chronological age at which children are expected to have developed perceptual ability in copying

is that of Lauretta Bender (1938). She found (only the performances of normal children are reported here) that children below the age of six could reproduce only fragmentary parts of the designs, whereas children of six were able to copy three of the simpler designs. Children of seven were able to copy four designs, and, with increasing age and maturity, developed the ability to copy more. Bender concluded that the performance on the test involved the cortical capacity to perceive designs as presented, the psychomotor capacity to reproduce them, and a factor she called attitude.

Bender found that six-and-seven year olds, when given a definite number of dots to copy, showed perseveration tendencies. Also, that these children frequently worked over or filled in the dots. When they attempted to copy a line of dots, the line tended to become wavy and deviate toward a vertical slant. This slant was demonstrated by the six-and-seven year olds when copying other designs. When copying hexagons for example, the whole figure was frequently rotated toward the vertical. They also exhibited a lack of spatial judgement. The lines tended to overlap, or the lines of the triangle failed to meet the sides of the hexagon.

It was interesting that Osterrith (1945) found the age of eleven to be the time when a child could copy correctly a complex of meaningless lines. Using children from age four to twelve as

subjects he found that the younger children drew vague figures with a few details added at random. It was not until the age of eleven or twelve that the children could reproduce the whole figure. When the same subjects were asked to pick out parts of the complex figure (squares, triangles, diagonals), those aged four-to-six could perceive only the outstanding figures; those aged seven-to-nine could see less outstanding details; and, those aged nine-to-twelve were able to identify the whole structure.

Osterrith concluded that when viewing complex figures, younger children see an undifferentiated group of stimuli from which they can identify only a few outstanding details, and with increasing maturity they develop the ability to perceive the whole complex.

Zinchenko (1962) investigated the eye movements of children age three-to-six, on a task which required them to examine the contours of unfamiliar material. Only in the six year old children did he find fully-formed methods of perceptual activity. Their eyes moved almost entirely along the contours of the figure. This age group made more movements than the younger children and their fixations were shorter. The five, four and three year olds performed respectively poorer.

Zinchenko conducted a second experiment in which the same children were shown pictures of familiar content (illustrations of fairy-tales). While the children looked at these pictures the move-

ments of their eyes were recorded. Analogous trajectories were observed by all age groups. Zinchenko concluded that the level of perceptual development is not an absolute characteristic of age. It must always be correlated with the material presented as the object of this activity.

From the findings of Osterrith and Zinchenko it may be inferred that when the stimulus is complex and has no relation to previous stimuli in the child's experience, the child does not see the configuration, nor is he able to distinguish the details sufficiently well to reproduce them. Perceptual readiness and experience appear to be important factors in a child's ability to coordinate eye and hand movement.

Hemminder (1953) investigated the responses of three-to-eight year olds to Rorschach cards. His findings concurred with those of Bender, Osterrith and Zinchenko. Three year olds were found to have immature perception, seeing an undifferentiated mass with few details. The four-and-five year olds more often noticed parts rather than the whole configuration. The six year olds demonstrated a marked increase in ability to see details, but they were seen as separate parts and not as a whole. The seven-and-eight year olds frequently responded by listing parts, but the whole configuration response increased considerably. Hemminder concluded, on the basis of twenty subjects

in each age level that children proceed through a process of maturation and learning during which perceptual ability matures from being able to see only an undifferentiated pattern to being able to see an integrated one.

Ames' (1953) study of Rorschach responses of pre-school and school children reported five year olds to be primarily global perceivers, although a few would give responses involving details. By five-and-a-half, children added many tiny details to the global perception and indicated some ability to generalize. He distinguished two types of perceivers among the six year olds, global and analytical, who were evenly distributed in the sample. The six year olds exhibited a strong tendency toward reversal of figure and ground, and form alone determined sixty percent of the responses. The children continued to perceive an increasing number of details up to the age of ten, when they shifted back to a more global type of perception.

From the studies reported above it is clear that research does not agree on the type of perception found in children at the ages of six and seven. When Goins (1958) classified the perceptual modes of 120 first grade children prior to their receiving tachistoscopic training, she was able to identify two types of perceivers by their performance of copy task. The children making the best scores on the tests were those who

could perceive a configuration and at the same time be aware of the parts. Low scores were assigned to those who perceived one part at a time. The age range of Goin's study was limited to being within twelve months of six-and-a-half. Goins concluded that perceptual ability develops gradually from birth, and that, although age level differences may be approximately set, there are individual differences within each age.

Right-Left Discrimination

The reversal tendency or right-left discrimination is a trait unique with the individual and a trait that appears to characterize poor readers. Fabian (1955) studied the reversal tendency of children from five-to-ten years of age as shown in executing the Bender designs. He found that prior to six years of age children looked at objects from any angle. He also observed from subsequent patterns, that the right-left discrimination must be a learned ability. On the basis of the performance of 586 normal children, Fabian concluded that circular movement, the perception of fragments, and other primitive gestalt tendencies slowly disappear or are inhibited as the normal child advances in age. For example, 80% of the pre-schoolers cited in his study rotated figures from horizontal to vertical; this figure dropped to 20% for children ages six-and-a-half to seven-and-a-half to nine year age group. Fabian identified the reversal tendency as

a genetic factor in agreement with Bender's concept. He further postulated that the gestalt forces of closure and proximity seem to be more compelling in childhood than in adulthood.

Benton (1960) found that when he compared their intelligence scores and right-left discrimination ability, children of superior intelligence showed an "acceleration in the development of right-left discriminative ability." Some children demonstrated systematic reversal patterns in response to instructions, which appeared to indicate that although the child was reversing the pattern, he was, in reality, showing discriminative ability in his consistency. The reversal tendency was found to be carried over into reading, with the result that such children obtained reading scores more than a year below those of the control group. Right-left discrimination, then, appears to be a perceptual skill that develops with physical and mental age and is also a function of learning. Although practice has been found to improve the individual's performance of discrimination, cerebral integrity of a certain type is a necessary condition, for mental defectives were found to show very poor ability for right-left discrimination (Harriman & Harriman, 1950; Garrison, 1958).

<u>Other Factors</u>

In addition to the organic and genetic factors comprising an individual's perceptual pattern, there is also the influence

of attitude, or, as others have termed it set. Uznadze (1961) definted set as: ".....that factor which conditions the organization of perception corresponding to the objective situation, in other words, conditions the 'taking of the objective situation into account' in the form of an organization of perception corresponding to this situation, i.e., conditions constant perception corresponding to the situation without the participation of conscious intellectual processes" (p. 434). This constant perception is developed on the basis of fixated set developed in the process of visual-motor experience (Uznadze, 1961; Paiger, 1961).

In relation to reading, a child's set must be adequate to the letter-symbol perceived or the set will be non-constant until the adequate set comes into being. In the form copying act then, we are measuring the organism-as-a-whole.

<u>Developmental Changes and Intelligence on the Bender Gestalt Test</u>

Koppitz (1958b, 1960, 1964) concluded that developmental differences in visual-motor perception are reflected in performance on the Bender Gestalt (hereafter B-G), and that visual-motor perception is closely related to language ability and other functions associated with intelligence in young children. Wewetzer (1959), Keller (1955), Clawson (1966), and Yudin (1967), supported Koppitz' claim.

In contrast there appeared to be no significant relationship

between the intelligence of adults and their performance on the B-G. Pascal and Suttell (1951) found that intelligence had little effect on the B-G score of normal adults. Pascal and Suttell's results were supported by Peek and Olsen (1955), Peek and Storms (1958), and Aaronson (1957).

It seems clear from the literature that B-G is related to intelligence in children but once visual-motor perception has fully matured the B-G can no longer serve this function. Koppitz (1958b) found the verbal IQ of the WISC to be significantly related to B-G performance in grades one and two ($P<.02$) but not in grades three and four ($P>.10$). She concluded that as children grow older, tests of verbal intelligence demand not only factual information but also logical reasoning and social understanding neither of which bear a clear relationship to form copying.

Koppitz (1964) also observed that after about age eight-or-nine, the B-G is less able to identify children of good ability, since almost all children reproduce the designs reasonably well by then. Following this age the B-G could still be used to identify delay or disturbance in visual-motor perception.

Based on a public school population of 1055 children, Koppitz (1960) established norms for B-G performance for the age range five to ten years (only the norms for normal children are reported here). The norms were based on her scoring system, a deviation scale of

thirty points. She found that the scores decreased with increasing chronological age. Of particular interest was the marked drop in scores between the ages of five-and-seven, after which there was gradual improvement until the age of nine and a levelling off thereafter. This scoring system which was adopted for the present thesis was validated by Miller et. al. (1962), and by Koppitz (1964), (correlations of r=.93 and r=.91 respectively, were reported).

CHAPTER IV

READING READINESS

The reading readiness problem was considered from four perspectives: (1) reading readiness studies; (2) prediction studies; (3) good and poor reader studies; and, (4) clinical observations. These categories did not exhaust all possibilities, but were sufficient for the scope of this study.

Prior to an evaluation of this research, the relationship of perceptual motor functioning to reading must be more clearly defined. Reading is a complex process involving both a reader and a writer. This process was defined by Tinker and Bond as: "reading involves the recognition of printed symbols which serve as stimuli for the recall of meanings built up through the reader's past experience. New meanings are built up through manipulation of concepts already in his possession. The organization of these meanings is governed by the clearly defined purposes of the reader" (1957, p.90). With a somewhat different theoretical and research orientation but still emphasizing the experiential factor Galperin talks about the process of forming mental actions: "(1) establishing a preliminary idea of the task; (2) mastering the action with objects; (3) mastering the action on the plane of speaking aloud; (4) transfer of the action to the mental plane; and, (5) final establishment of the mental action" (1954, p. 166). To Gibson

this process was: (1) making discriminative responses to graphic symbols; (2) decoding these symbols to speech; and, (3) getting meaning from the printed page" (1965, p. 1066). Two salient dimensions are reflected in the above author's views: (1) some aspects of reading must be mastered before others and have an essential function in a sequence of development of the final skill; and, (2) in the final process the individual's attributes are reflected in his interpretation, evaluation, and attitude about the meaning.

Development toward reading readiness begins shortly after birth. Although, two authors (Kawi & Pasamanick; 1958) entertained the notion of a continuum of reproductive causalty ranging from neonatal death through cerebral palsy to behavior and learning deviations to normal at the other end, with reading ability or disability constituting a component of this continuum. The child begins to have experiences with objects and people, experiences which are part of his developing understanding of words and ideas. A child gradually develops his vocabulary and learns to construct sentences. As the child's auditory and visual discrimination increase, he also develops a variety of concepts. If the environmental factors are favorable, the child develops positive attitudes and an adequate facility in understanding and using language which is necessary for learning to read. There have been found marked differences in the rate at which children develop

the readiness for learning to read. If one attempted to set an age range, it would have to extend from about five-to-seven for children who have had a favorable environment, and whose mental growth, emotional adjustment, and physical status were normal.

<u>Reading Readiness Studies</u>

There was considerable evidence to suggest that form copying tests are effective as screening devices for reading readiness when used early in the reading program (Goins, 1958; Koppitz, 1958b; Keogh & Smith, 1967; Yudin, 1967). Several factors may account for this observation. One is that the kinds of functions measured by form copying are similar to those most crucial in the beginning reading program. Functions such as spatial orientation, discrimination and identification, and organization of details (Piaget & Inhelder, 1965; Faust & Faust, 1966; Luria, 1966). At the middle and upper grades of elementary school, the reading program tends to be more heavily weighed with verbal and intelligence factors (Koppitz, 1958b), and reading may be less directly related to the developmental factor of visual-motor perception.

Koppitz (1958b) found that by the fifth grade, copying of simple line designs was unrelated to reading achievement. Findings consistent with those of Clawson (1962) and Keogh and Smith (1967).

Another factor may be the rate of development of visual-motor

perception. Examination of the characteristics of form copying independent of reading (Faust & Faust, 1966) revealed that copying ability reaches a relatively high level of accuracy for most children by the middle school years.

Prediction Studies

Reading prediction studies using form copying tests have indicated a moderate, positive relationship between copying ability and reading ability in the early grades.

Goins (1953) correlated a number of visual perception and reading tests in her study of their relationship at the first grade level. Of the fourteen tests used, the form copying and reversals tests correlated highest with reading achievement; r=.52 and r=.50 respectively.

Russell (1955) found that the maturational level of perceptual functioning as measured by the B-G was a better predictor of reading readiness than was organismic age.*

Langmeier (1961) supported Russell's study. He found that height and weight did not correlate significantly with first grade achievement. Within the six year age group he found considerable

*Organismic age, devised by W.C. Olson, a measure of central tendency of a child's growth, was computed in Russell's study from height, weight, grip, dental, and mental ages.

individual differences in performance and behavioral maturity. When Langmeier correlated the results of a draw-a-man and form copying with the results of achievement at the end of the first semester, he found correlations of r=.46 and r=.39 respectively.

Koppitz et. al. (1960) evaluated the Draw-A-Man Test and the B-G as predictors of first grade reading achievement. They presented both tests to 143 first grade children then evaluated them on standard achievement tests at the end of the year. Both the B-G and the figure drawing test correlated significantly with the achievement measures (r=.55, r=.46); the multiple correlations for the two predicting measures was higher than for either test singly (r=.65). Koppitz et. al. considered that the human figure drawing test measured aspects of intelligence and emotional adjustment which were pertinent to learning success, but which were not directly measured by the B-G. These findings suggested that the tests were useful in group prediction at the first grade level.

Jirásek (1966) found a significant relationship (P=<.001) between the school maturity grade, assigned on the basis of performance in various copying tasks, and pencil handling and marks in Czech. He concluded, based on his data gained from 596 first grade children: "in selecting test material, we have proceeded from the results of our previous research work, according to which the most important sources of getting to know a child's psychology are the child's graphic manifestations and performance" (p.720).

Koppitz et. al. (1960) found that the B-G given at the beginning of the first grade predicted with as much accuracy as did the more traditional reading readiness tests. Comparing the scores on the B-G at kindergarten with the reading achievement measures at the end of grade one, Smith and Keogh (1963) found that the correlations between total B-G score and the first grade teachers' ratings of reading ability was r=.42, for a group of 149 children. Re-examination of the correlations with the age variable partialled out did not change the results appreciably. In a recent (1967) study, Keogh and Smith, using a longitudinal paradigm covering a seven year span, concluded that B-G performance data gathered on 73 children at grade one predicted with 82% accuracy the reading achievement of those children in grade six.

Good and Poor Readers Studies

Fabian (1945) compared the performance of beginning readers and older good and poor readers on the B-G test. He found that, as beginning readers, 50% of the boys and 36% of the girls rotated horizontal figures, and 66% of the older poor readers also make similar errors. Fabian concluded that rotation is a developmental phenomena which usually disappeared by age seven or eight.

Fildes (1921) discovered that poor readers were not inferior to good readers in distinguishing like and unlike forms, but that poor readers were not as proficient in distinguishing orientational differences of forms. She concluded that poor readers show weaknesses

only in orientational aspects of discrimination rather than having any general weakness in visual-motor perception.

Frank (1935) also found that poor readers made more orientational errors than good readers. Poor readers confused words and letters with similar structure, such as the letters b and d, thus making errors similar to those of beginning readers.

The most comprehensive study of good and poor readers' performance on the B-G was reported by Koppitz (1958b, 1960). She found two major types of deviations: (1) the general inability to control lines in terms of direction and shape, demonstrated by errors of rotation; and, (2) inability to integrate parts into wholes, and the inability to control or terminate activity.

All authors agreed that for success in reading, a child must function in the visual-motor area at a maturational level closer to adult status than to pre-reader status. They also agreed that the poor readers tended to function like the pre-readers on form copying tasks.

Clinical Studies

The medical and clinical literature contained a number of case studies describing difficulty with copying as part of a general reading disability syndrome (Castner, 1935; DeHirsch, 1954, 1957; Zangwill, 1960).

The etiology of reading disability was often put into a framework of emotional disturbance (Jarvis, 1958). An alternate

view emphasized the relationship between visual-motor perception and reading (Bender, 1938; Lachman, 1950; Pascal & Suttell, 1955; Clawson, 1962; Koppitz, 1964; Luria, 1965). This latter approach suggests that reading disability may be characterized by a lag in visual-motor development.

In a summary of French work on reading problems, Simon (1957) noted that disruption of spatial organization in copying appeared related to reading problems and was reflected in B-G performance. Clawson (1966) considered the B-G errors which related to incorrect numbers of units in designs as particularly associated with reading disability.

From extensive clinical work with reading disability cases DeHirsch (1957) defined primitivization, separation, and slant, as errors typical of children with severe reading problems. She concluded: "the inability to cope with spatial relationships is of primary importance since in reading the child has to deal with a pattern of lines laid out in space. A developmental lag in this area will thus show up in the youngster's performance" (p. 569).

The clinical reports tended to be quite subjective. They were usually based on a single case and their conclusions may not be generalizable to a more normal school population. At the same time these findings offered further insights into the relationship of copying and reading.

Summary of Evidence

Copying geometric designs involved both visual and motor components of perceptual functioning. Significant changes in form copying ability occur between the ages of five and seven. A wide range of individual differences exists in the form copying ability in children.

A number of investigators hypothesized that reading ability depends upon similar factors as those which underlie copying ability in the preliminary stages of learning to read. Clinical evidence suggested poor readers are often poor in copying ability. The B-G and other copying tests have revealed a low positive relationship between copying and reading. Previous research has been promising but not definitive.

CHAPTER V

METHOD

General

Firstly, the study was designed to determine whether levels of perceptual motor functioning can be identified among a sample of grades one and two children. An improvement in performance with progression in age and grade was expected. Scores for girls were expected to be higher than scores for boys.

The second purpose was to investigate the amount of correlation between form copying ability and reading ability. A positive correlation was expected with the size decreasing as age and grade increased.

The third aim was to evaluate the feasibility of using a group method of administering the form copying test. It was expected that the usually prohibitive time factor would be overcome with this mode of administration.

Subjects

Grades one and two pupils were selected for this research since it was concerned with the child's initial success in a formal reading program.

The *Ss* were 62 first and second grade pupils from one school of the Edmonton Public School System. There were 31 *Ss* from grade one whose mean age was 6-6 yrs. (range: 6-1 yrs. to 7-1 yrs). There were 31 *Ss* from grade two whose mean age was 7-7 yrs. (range: 7-1 yrs. to 8-5 yrs.). One first grade *S* demonstrated signs of psychological

difficulties, and one second grade S did not complete all parts of the program due to medical reasons. Neither of these S's results were included in the final calculations, leaving the final sample at 60Ss. See Table I for the breakdown of the group by age, grade, and sex.

TABLE I

DISTRIBUTION OF SUBJECTS BY AGE*, GRADE, AND SEX

				Grades	
Age	N	Boys	Girls	1	2
6.0-6.5	14	7	7	14	
6.6-6.11	13	7	6	13	
7.0-7.5	11	5	6	3**	8***
7.6-7.11	18	9	9		18
8.0-8.5	4	1	3		4

*ages as of January 15

**2 boys

***5 girls

Each grade represented one entire class of pupils to the exclusion of all others. Both groups were designated by the school principal. The sample was not necessarily "normal", but was assumed to be representative.

Materials

Every S was given a booklet containing ten blank white pages 5½" x 8" in size, two number two elementary pencils, an eraser, and a copy of each of the three Stanford, Primary I, Battery reading sub-tests: (1) Word Reading; (2) Paragraph Meaning; and, (3) Word Study Skills. A Kodak, K.S. 4312, manually adjustable, carousel camera, the nine Wetheimer figures reproduced by University of Alberta's Audio Visual Department, on individual film frames to a scale which represented the same ratio of figure size to card size as is on the standard B-G cards (Bender, 1938), to fit the Kodak slide projector, and one tripod mounted 6' x 6' viewing screen were also used.

Experimental Design

Keogh and Smith (1961) demonstrated that the B-G can be administered successfully as a group test to school beginners. They compared performance on the B-G using two different types of group administration, and the regular individual administration. They reported no statistically significant differences in the B-G scores between the various methods of administration. The most effective method of group administration according to Keogh and Smith was to present each individual design on a large card at the front of the room and ask the Ss to copy it on a blank page of a booklet. This latter method was termed administration method "B".

Since Keogh and Smith's original experimental design, their methodology has been used by two other researchers, Faust and Faust (1966) and Yudin (1967). This study concerned itself with modifying method "B", to render it more useful. A pilot study proved promising and workable. The group administration method used in this study is described in detail below.

Modification of Method "B"

The viewing screen was placed at the front of the room. The auxiliary lights, which supplied extra illumination to the blackboard were switched off placing some shadow on the screen. In this way extra contrast between figure and ground was provided. The camera was placed 22' from the screen and focused so that: (1) the figure was clear of haze; and, (2) the figure was so magnified that it filled the screen in height and/or width. The camera was then switched off. This modified method was termed method "C".

The design called for two groups of Ss, one grade one group and one grade two group, to reproduce the nine Wertheimer figures, administered by method "C", followed immediately by performance on the three reading sub-tests. The figures were flashed on the screen, in the A---8 sequential order, one-at-a-time. No time criterion was placed on any figure. As each figure was completed by every member of the group, the next figure was displayed. In this manner all Ss copied the figures at the same time. The reading

tests were administered to each group in the manner designated in the publisher's manual. A rest period of five minutes was called after the completion of each test.

All tests were conducted in each group's respective classroom by the regular classroom teacher and by the E. Each S sat in his accustomed seat. No S was further than 20' from nor closer than 5' to the screen.

The testing date was mid-January, by which time the first grade Ss had completed five months of formal schooling and the second year Ss had completed one year and five months of formal schooling. All testing was conducted in the morning.

Procedure

The individual booklets, pencils and erasers were placed on the S's desks. The figures were placed in the carousel. At the start of the session, the classroom teacher read the following instructions:

> Good morning class. Each child will find a booklet, two pencils, and an erasure on his desk. Here is what I want you to do with them. Do you all see this screen? We are going to show you some figures on this screen. We want you to copy the first figure that you see onto the first page of your booklet. When all of you have finished the figure, we will show you another one. You are to turn your page to the next blank page and copy it there. Try to copy the figures exactly as you see them.

Then the essential points were summarized and care taken (due to the ages of the Ss) to ensure that every S understood

exactly the nature of the task.

The figures were presented one-at-a-time, the Ss being queried in each case if they were completed, prior to switching to the next figure.

Upon completion of the form copying test, the reading sub-tests were administered in the following order:

(1) "Word Reading", which was accepted as a measure of a S's ability to analyze a word without the aid of context.

(2) "Paragraph Meaning", which was accepted as a measure of a S's ability to comprehend connected discourse.

(3) "Word Study Skills", which was accepted as a measure of a S's ability to discriminate appearingly similar terms.

Scoring

The B-G profiles were scored by two judges using the Koppitz Revised Developmental Scoring System (1964). One judge had three years clinical experience, the second judge (E) learned the system from the manual and by assistance from the first judge.

The Koppitz system was designed specifically for scoring the B-G reproductions of primary school children. The higher score the poorer the performance. The maximum score is 30. Deviations, or errors, are scored "1" or "0". Koppitz (1964) devised norms for each six month age group ranging from 5-1 yrs. to 10-11 yrs. These norms were used in this study.

The three sub-tests of the S.A.T. were scored according to the published directions. Only raw scores were used in the data analysis.

Statistical Analysis

The results from this study were arranged and reported in the following chapter and may be considered as falling into the following two categories, (Appendix a contains the raw scores upon which the statistical analysis were conducted):

(1) Findings regarding the relationship of age, grade, and sex to form copying.

(2) Findings regarding the relationship of form copying to reading.

CHAPTER VI

RESULTS

The presentation of the derived data was divided into two parts in the present chapter. In part one, the results of the investigation into the development of perceptual abilities were examined. In part two, the relation of those abilities to reading was analyzed.

Part 1

Visual perception abilities as manifest in form copying were studied to ascertain their development with age, grade, and sex. Because of the importance of the reliability of the B-G scoring to the evaluation of these, and subsequent variables, it was discussed first.

Reliability

Two judges (X,Y) scored the 60 B-G profiles independently of each other. To establish rater reliability, Pearson Product-Moment Correlations, converted to Fisher's-z for averaging (Downie and Heath, 1959, p. 185) were computed on the individual designs, mean score, and total score. These results are found in Table II.

TABLE II

PEARSON PRODUCT-MOMENT CORRELATION COEFFICIENTS BETWEEN RATERS BY INDIVIDUAL DESIGN, TOTAL SCORE, AND MEAN SCORE. (N=60)

	DESIGN									
	A	1	2	3	4	5	6	7	8	TOTAL SCORE
r=	.81	.67	.76	.65	.63	.69	.71	.68	.70	.82

MEAN rater score, including total score, r=.71

Although all correlations were high, analysis of the individual designs showed that some designs are more rateable than others. For example, design A, was rated most consistently; design 4, the least consistently. The most reliable score was the total score, suggesting that it be used for subsequent data analyses rather than any individual design. This conclusion concurred with Miller's (1963) findings.

The reliability of the raters was found to be at an acceptable level ($P<.01$) which suggested that : (1) the Koppitz scoring system is viable; and, (2) the system can be used as a research tool with considerable confidence.

Form Copying

Means and standard deviations were determined for each six-month age level, for boys and girls, both grade levels for boys and girls, and for the total N of each category. All computations were based on the total score of the nine designs. These results are found in Table III.

Comparison of the trends of mean scores by age categories revealed a considerable improvement immediately after the 6 to 6½-year old age group, then a levelling off in performance. These findings are in agreement with Faust and Faust (1966) who proposed an early levelling off in performance, but disagree with Koppitz' (1964) claim that levelling off does not occur until approximately age 7½ to 8.

TABLE III

BENDER GESTALT MEANS AND STANDARD DEVIATIONS BY AGE, GRADE, SEX, AND TOTAL N FOR EACH GROUP

	BOYS			GIRLS			BOYS AND GIRLS		
AGE	M	SD	N	M	SD	N	M	SD	N
6.0-6.5	6.7	3.5	7	5.4	3.4	7	6.1	3.4	14
6.6-6.11	4.3	1.5	7	3.3	1.9	6	3.8	2.0	13
7.0-7.5	4.4	1.5	5	2.5	1.7	6	3.4	1.9	11
7.6-7-11	3.8	2.2	9	2.8	2.0	9	3.0	2.1	18
8.0-8.5	2.0	0.0	1	6.7	1.2	3	5.0	2.8	4

	BOYS			GIRLS			BOYS AND GIRLS		
Grade 1	M	SD	N	M	SD	N	M	SD	N
	5.1	2.8	16	4.7	2.7	14	5.0	2.7	30
Grade 2	M	SD	N	M	SD	N	M	SD	N
	3.7	2.3	14	3.1	2.4	16	3.4	2.4	30

The one exception to this sequence was the three 8 to 8½-year old girls. Their performance was significantly poorer ($P<.01$) and resembled that of the 6 to 6½-year old group. The scores of these three Ss did not alter the overall results (when partialled out the total score did not differ significantly) and were included in the final analyses.

The difference in performance by six-month age groups was significant ($P<.01$) only between the two youngest groups. Thereafter only a positive trend was indicated. The mean of the 7 to 7½-year old boys (4.4) was actually higher than that of the 6½ to 7-year old boys (4.3). The same reversal was found between the 7½ to 8-year old girls (2.8) and the 7 to 7½-year old girls (2.5). The youngest group also demonstrated the largest standard deviation (± 3.4).

When the six-year olds and seven-year olds (with the four eight-year olds included in the latter group) were compared a significant difference ($P>.01$) was found.

Comparison of age mean scores with the reported norms (Koppitz, 1962) showed an interesting finding. The Ss of this study performed significantly better ($P<.01$) in four of the five age groups - the 8 to 8½-year old group performed significantly poorer ($P<.01$).

The difference in performance between grades one and two was significant ($P>.01$). Koppitz reported a mean of 4.7 ($SD=\pm 3.2$) for grade two and a mean of 8.1 ($SD=\pm 4.4$) for grade one. The grade two

mean for this sample was 3.4 (SD=±2.4) and the grade one mean was 5.0 (SD=±2.7). A significant difference of $P<.05$ and $P<.01$ respectively between norm and sample was found. It was not apparent whether these disagreements (age and/or grade) were due to characteristics of the sample, interpretation of the scores, or norms cited.

Although the trend favored the girls in all cases, no significant differences (excluding the 8 to 8½-year olds) were found in boy-girl performance at any age or grade. Bender (1938) suggested that girls mature slightly earlier in visual-motor perception. With respect to this sample, that difference was not statistically significant.

<u>Summary</u>

Two judges scored the B-G profiles. A range of 19 points in Pearson Product-Moments was demonstrated. The largest single correlation, total score, was used in all subsequent analyses.

A significant improvement in form copying ability was found between age six to seven. When analyzed in six-month increments only the two youngest groups showed a significant difference; the scores thereafter levelled off. The 8 to 8½-year old group reversed this tendency. Their data however, did not effect the total group score. The expectation of improvement in form copying ability with increase in age was met, but improvement by six-month increments was not entirely supported.

Improvement in performance between grades one and two was

highly significant, thus meeting that expectation.

There was considerable agreement (excluding the 8 to 8½-year old girls) between sexes within age and grade group. Although the trend favored the girls at all levels, the differences were not significant. This finding was contrary to expectations.

On the basis of these results, age, or grade level rather than sex appeared to be the more reliable dimensions.

Part 2

The second part of the analyses concerned the relationship of form copying scores to reading scores. Because the final correlations depend on the reading scores they are discussed first.

Reading Scores

Means and standard deviations were determined by age, grade, separately by sex, and for the total N of each category. These computations were based on the total score of the S.A.T. These results are found in Table IV.

A similar pattern to the form copying results emerged. The girls were slightly but not significantly favored. Sub-test scores revealed the same trend. The age-grade relationship was also similar. The six and seven-year olds and the grades one and two Ss both showed significant ($P<.01$) differences. The lack of statistical difference in sex performance suggested that as in the case of the form copying scores that the total scores be used in subsequent analyses.

TABLE IV

READING MEANS AND STANDARD DEVIATIONS BY
AGE, GRADE, SEX, AND TOTAL N FOR EACH CATEGORY

AGE	BOYS			GIRLS			BOYS AND GIRLS		
	M	SD	N	M	SD	N	M	SD	N
6.0-6.11	59.6	21.5	24	60.6	22.6	13	60.1	22.1	27
7.0-7.11	109.4	22.9	16*	112.1	15.0	17**	110.8	19.2	33***

GRADE							BOYS AND GIRLS		
	M	SD	N	M	SD	N	M	SD	N
1	58.7	20.5	16	61.4	21.9	14	60.0	21.2	30
2	114.6	6.7	14	117.6	11.3	16	116.0	9.5	30

*includes 1, eight-year old
**includes 3, eight-year olds
***includes 4, eight-year olds

Distribution

The reading test total score consisted of the sum of the raw scores on the three sub-tests. The total possible score was 130. The range of scores were: age six, 33-125; age seven, 43-128; grade one, 40-125; grade two, 91-128. Several of the second graders scored high on the reading test suggesting a ceiling effect, and raising the question of linearity between reading and B-G scores. Scattergrams were plotted for the four conditions. No significant discrepancy was noted, and the Pearson r was accepted as the appropriate measure of relationship.

Relationship of Bender Gestalt and Reading Scores

The total scores of the B-G tests and the reading test were correlated. These results are found in Table V.

TABLE V

PEARSON PRODUCT-MOMENT CORRELATION COEFFICIENTS BETWEEN TOTAL READING SCORES AND TOTAL BENDER GESTALT SCORES

for Age		for Grade	
6	*-.43**	1	-.41
7	-.38	2	-.37

*All correlations are negative as the B-G is scored for errors
**All correlations are significant $P<.05$

The hypotheses was supported at the 5% level of confidence. It is shown in Table V that the correlations are lower as age and grade increased. However, the differences between ages and between grades was not significant. The magnitude of the correlations was in the low medium range, rendering individual prediction questionable.

An interesting corroborating observation was made when B-G and reading scores were ranked by grade (see Appendix a) and examined subjectively. An inspection revealed that ninteen Ss (nine from grade one; ten from grade two) were high on both dimensions and two Ss failed to meet the criterion by less than one point. (This arbitrary criterion was establised by ranking the raw data separately for form copying and reading then dividing the distributions into two equal halves. Above the median was termed "high", and below termed "low"). Similarly twenty Ss (ten from grade one; ten from grade two) were low on both dimensions and one S (grade one) failed to meet the criterion by less than three points. Ten Ss (five from grade one; five from grade two) were high on reading but low on B-G. Eleven Ss (six from grade one; five from grade two) were high on B-G but low on reading. Thus the B-G could predict with approximately 65% accuracy whether a S was high or low in performance on a reading test. Although no specific conclusions could be drawn from so few cases it was clear that among this

sample of first and second grade pupils the degree of competence in perceptual motor ability varies greatly. Coupled with the magnitude of the correlations, these observations led one to conclude that the above described techniques of measuring perceptual motor development are adequate as a gross screening device only.

Summary

A similar trend was found for the reading scores as was found for the form copying scores. The differences between ages and between grades were significant. There was no significant sex difference.

The hypothesis was supported at the 5% level of confidence; but the correlations were in the low medium range. The expectation of lower correlations as age and grade increased was not significantly met.

A detailed analysis of form copying and reading scores revealed a kaleidoscope of individual differences and brought the question of individual prediction into focus.

CHAPTER VII

DISCUSSION

This study was practical in nature. The optimal placement of children in the primary grades and the need for early identification of potentially successful and unsuccessful readers are of real importance in the school setting.

Adequacy and efficiency in visual form perception were considered crucial ingredients in the mastery of one symbolic task-reading. The secondary objective of this investigation was to develop a useful mode for group administration of a form copying test which could serve as a measure of children's ability to perceive form with accuracy and efficiency.

Before analyzing the major problem, the relation of perceptual motor development to reading, the group administration is discussed.

It was apparent that group administration had both advantages and disadvantages. As a time-saving device it was valuable. The mean time for the two administrations was eleven minutes. De Hirsch (1957) and Clawson (1966) reported administration times ranging from three to fifty-six minutes for individual administration. Koppitz (1962) reported a range of five to seven minutes for normal children.

The major disadvantage was that it deprived the researcher of the opportunity to observe the individual child at close range

and to study his work habits. By asking the children to copy each design on a separate page and by requiring the child to work at the speed of the slowest child the E relinquished: (1) the possibility of analyzing the individual child's organization of all nine figures; (2) the possibility of examining the child's use of time and space; and, (3) placed some pressure on the slower children to conform to the class norm. Although the study was not designed to investigate that observation, this E feels that those children who were pressured, were the ones who could least afford it.

Another question, which the group administration raised, concerned the accommodation of the lens of the eye. It is well-known that the lens becomes more convex for near vision and less so for far vision. Gregory (1966), in discussing the role of the brain in different angles of convergence of the eyes, suggested that different areas of the brain function during different gradations of depth perception and, "that size and space constancy function according to distance" (p. 234). Moreover, if one was to speculate using Anokhin's (1966) return afferentation model, then perhaps during successive stages of compensatory adjustments the, "acceptor of action" is playing completely different roles. Luria (1966) added some credence to this view when he suggested that different pathways of return afferentation seemed to be operative during near and far vision.

What effect these observations have on the stimulus design being demonstrated at the front of the room as opposed to the stimulus card being close the individual child, one can only speculate. Keogh and Smith (1961) found no significant difference between the two modes. Faust and Faust (1966) and Yudin (1967) supported their claim. It could be that the reproductions are so gross, and that in young children the muscles of the eye are reported to be quite flexible so that the angle of convergence is not a major factor to consider.

It is debatable whether it is in the long run more economical to administer the form-copying task to children in a group and to obtain less detailed information from each one, or to administer it to each child individually and to obtain more information from each protocol. It would certainly be of great value to have different methods of administration available for use to meet the requirements of the situation. One implication for future research would be to investigate which method is most effective in which situation.

The scoring system used on the B-G profiles in this study (Koppitz, 1964) is completely standardized and the scoring manual is well detailed. However, it was felt that it was too time consuming, considering that the results of this study did not differ in magnitude from previous studies which used less complicated scoring procedures (Clawson, 1966, Jirásek, 1966). Jirásek (1966) has developed a simple "comparative figures" approach to scoring,

and Faust and Faust (1966) have developed an equally simple 5-point scale. Some implications for future research are: (1) replicate this study using Jirásek's and/or Faust and Faust's procedures; (2) develop a system to meet the needs of early elementary gross screening; and, (3) do a norming study using one or more of the systems -- because, at the present time and in the near future, group administration of form copying tests is essential for large scale school screening.

Another finding of interest concerned the sex difference in performance on the B-G and on the reading measures. It is often noted that girls tend to achieve higher than boys in primary grade programs. Reports on reading readiness (Prescott, 1957) and reading achievement (Hughes, 1953) supported this observation but noted that by the fourth grade these differences were no longer significant. It is not clear whether this early difference in performance is a social phenomenon or whether it is related to differential development rates.

Koppitz (1964) hypothesized that perceptual motor factors as measured by the B-G, were more important during the beginning reading program than at higher grade levels. The 1960 normative studies suggested that girls are somewhat more developed in form copying ability at the age corresponding to the start of school. Therefore, they may be favored in the first reading curricula.

The results of this study did not support Prescott's and Hughes' claims of a significant difference in performance. Moreover, the norms were found to be too high in all cases. Although, the trend did not favor the girls in every category, and thus supported Koppitz' claim of no significant difference in sex performance. Notwithstanding the size of the sample, the results of this study lend some support to the contention that girls develop more rapidly in visual motor perception but that the difference is not statistically significant.

The three 8 to 8½-year old girls were exceptional. Thus accounting for their deviation from the trend. Otherwise, the results of this study clearly defined the differences in perceptual motor development between the ages of 6 and 7, and between grades 1 and 2. These findings are consistent with those in previous studies.

The correlations between the B-G scores and the reading scores were statistically significant at both the first and second grade and for ages 6 and 7. Care is suggested in individual prediction however, due to the low magnitude of the correlations. This finding was also consistent with previous studies.

Evaluation of the individual case results proved interesting. The B-G could predict with 65% accuracy whether a S would be high or low on the reading dimension. This finding suggested that method "C" of administering the B-G to a group of children

is appropriate as a screening device and that it might prove useful for classroom teachers.

There is nothing surprising in this report. However, some important implications for future research and for teaching reading are implicit in the findings.

As noted above, words are complex designs made up of related geometric forms in which spatial orientation and distance between letters are crucial. If the reproductions of simple geometric designs are fragmented it seems reasonable to assume that the complex patterns in words may be fragmented. What indicators on form copying designs are associated with what type of materials to provide for the child to compensate for his lag, would be an invaluable aid to the school practitioner.

An investigation into the factors of lag is suggested. Langmeier, Langmeierova, and Matejcek (1966) offered the view that age-determined immaturity, emotional problems, social and cultural deprivation, modest endowment, all effect a child's school career. They stated: "Without consideration of these adverse factors the diagnosis of physical and psychological immaturity cannot be complete and a valid prognosis cannot be made" (p. 350). In other words, immature perceptual-motor development needs to be investigated. In the classroom alone, innumerable activities which are often thought of as "play" by the children

and "just play" by the teacher may be more basic and worthwhile than are word recognition "games" for children with perceptual motor immaturities. These experiences are a child's way of learning, through pure research in the qualities of form. Through such experimentation and manipulation children are learning things which are fundamental to reading. Perhaps we could devise specific experiences to aid the child to actualize his full potential.

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APPENDIX TABLES

TABLE A

BENDER-GESTALT AND READING SUB-TEST AND TOTAL RAW SCORES OF GRADE 1 CHILDREN BY AGE AND SEX

	AGE			READING			
				Sub-Test			
SEX	Y.	M.	BENDER	W.R.	P.M.	W.S.S.	TOTAL
F	6	1	0	16	18	33	67
M	6	2	2	24	10	27	61
F	6	2	4	25	20	43	88
M	6	3	6	16	13	28	57
F	6	3	9	4	7	22	33
M	6	3	11	12	5	23	40
F	6	4	3	10	10	23	43
M	6	4	6	24	21	41	83
M	6	4	8	15	9	29	53
M	6	4	11	17	8	27	52
M	6	5	3	19	12	36	67
F	6	5	6	23	17	36	76
F	6	5	7	5	7	28	40
F	6	5	9	12	4	19	35
M	6	6	5	13	7	21	41
F	6	7	2	19	18	38	75
F	6	7	2	13	5	36	54
M	6	7	4	12	5	30	47
M	6	8	2	13	9	24	46
M	6	8	6	13	9	31	53
M	6	9	2	20	2	40	62
M	6	9	6	11	7	27	45
M	6	9	7	35	35	55	125
F	6	9	8	15	9	22	46
F	6	10	2	31	34	49	114
F	6	10	5	16	13	37	66
F	6	10	5	16	10	25	51
M	7	0	3	11	11	21	43
M	7	0	3	14	9	38	61
F	7	1	5	19	24	29	72

TABLE B

BENDER-GESTALT AND READING SUB-TEST AND TOTAL RAW SCORES OF GRADE 2 CHILDREN BY AGE AND SEX

	AGE			READING			
				Sub-Test			
SEX	Y.	M.	BENDER	W.R.	P.M.	W.S.S.	TOTAL
F	7	1	2	31	34	44	107
M	7	2	1	35	37	55	127
F	7	2	5	32	30	50	112
M	7	2	7	30	36	51	117
M	7	3	5	25	32	40	97
M	7	1	4	31	32	44	107
F	7	5	1	35	38	55	128
F	7	5	1	35	38	54	127
F	7	6	0	34	34	56	124
F	7	7	1	34	38	49	121
M	7	7	5	22	33	45	100
F	7	8	0	34	35	52	121
F	7	8	1	35	36	53	124
M	7	8	2	33	35	54	122
M	7	8	2	31	32	47	110
M	7	9	2	34	33	52	119
M	7	9	2	35	36	54	225
F	7	9	3	27	24	40	91
F	7	10	2	33	37	50	120
M	7	10	4	32	34	49	115
M	7	10	4	34	37	55	126
F	7	10	7	27	29	43	99
F	7	11	3	34	34	54	112
F	7	11	6	34	36	52	122
M	7	11	8	34	38	50	122
F	7	11	3	32	31	46	109
M	8	0	2	34	33	50	117
F	8	0	8	33	38	44	115
F	8	1	7	32	34	34	100
F	8	5	5	27	35	44	106

TABLE C

RANKED SCORES BY GRADE

GRADE 1				GRADE 2			
RANKED BENDER	WITH READING	RANKED READING	WITH BENDER	RANKED BENDER	WITH READING	RANKED READING	WITH BENDER
0	67	125	6	0	121	128	1
2	46	114	2	0	124	127	1
2	54	88	4	1	117	127	1
2	61	86	6	1	121	126	4
2	62	76	6	1	124	125	2
2	75	75	2	1	127	124	0
2	114	72	5	1	127	124	1
3	43	67	3	1	128	122	8
3	43	67	0	2	110	122	3
3	61	66	5	2	114	122	6
3	67	62	2	2	119	122	2
4	47	61	2	2	120	121	1
4	88	61	3	2	122	121	0
5	41	57	6	2	125	120	2
5	45	54	2	3	91	119	5
5	51	53	8	3	109	119	1
5	66	53	6	3	122	117	7
5	72	52	11	4	107	117	1
6	53	51	5	4	115	115	4
6	57	47	4	4	126	115	8
6	76	46	7	5	97	114	2
6	86	46	2	5	100	114	7
6	125	45	5	5	106	110	2
7	40	43	3	5	119	109	3
7	46	43	3	6	122	107	4
8	53	41	5	7	99	106	5
9	33	40	11	7	114	100	5
9	35	40	7	7	117	99	7
11	40	35	9	8	115	97	5
11	52	33	9	8	122	91	3

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